Amphibian and Reptile Inventory and Monitoring: Redwood National Park

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Report to
National Park Service

22 November 2004

ABSTRACT.—

INTRODUCTION

Amphibian declines have occurred in many populations throughout western North America and are of management concern in most National Park units. Most of the parks in the Klamath network are significantly deficient in their "Level I" Aquatic and Terrestrial Inventories for amphibians and reptiles, which is part of the National Park Service's Inventory and Monitoring Program.

Redwood National Park is a large unit with 44,296 ha (112,513 ac or ca. 175 mi^2). Further, the landscape is highly diverse from coastal rocky beachs and adjacent bluffs, through dense stands of old-growth redwood, eastward into mixed conifer-hardwoods with open grasslands and oak-woodland.

The amphibians and reptiles of Redwood National Parks received some attention by several previous efforts. These include two park distributional surveys (unpubl. on file at park), a study comparing logged and natural redwood forest (Bury 1982), one study of stream amphibians (Welsh and Ollivier 1998; Welsh et al. 1997), and an overview (Cooperrider et al. 2000). Basic distributional work is lacking for most of the park (probably >95% of its surface area). Intensive ecological studies or research on one community is sparse to non-existent.

Because these efforts have likely identified most common amphibian and reptile species for the Park, our inventory was intended to target rare species, or those with limited or unknown distributions in the Park. Our primary effort focused on unique or limited habitats in the park that have historically been less targeted in inventory accounts. Primary habitats for our visit included: (1) Steep talus coastal slopes; (2) Bald Hills (open grasslands and oak savanna); (3) Ponds/bogs; and (4) Coastal/forest interface. Further, we were interested in exploring new ways to sample and monitor the herpetofauna for future endeavors (see Bury and Hyde 2004).

MATERIAL AND METHODS

Inventories consisted of standard herpetological techniques including turning cover objects on land and using dip net sweeps in ponds or streams. Sites were searched in pairs by moving continuously across the landscape looking for prime habitats. No more than two person hours was spent at any given location. Sampling was in one week 22-26 March 2003 with a team of 4 field biologists.

RESULTS

We visited 11 sites (Fig. 1), including two long visits at Dolason Prairie Trail (higher elevation) and Skunk Cabbage Trail (lowlands). The weather was cool and damp throughout our visit with air temperatures ranging from 3-12°C.

We found 16 species of reptiles and amphibians: 8 salamanders, 2 frogs, 1 toad, 1 snake, and 4 lizards (Table 1). The cool and wet weather during our surveys likely prevented us from documenting greater reptile diversity that was expected, particularly on the bald hills and coastal talus areas if weather was warmer. Details of the complete inventory dataset are in the Appendix.

One highlight of this inventory was discovery of high density and diversity of amphibians found during a short stop at the Big Bluffs Overlook on the coast just south of the mouth of the Klamath River. We documented *Bufo americanus*, *Aneides flavipunctatus*, and *Plethodon elongatus* within about 1 m of each other in a large sunny talus pile on a steep slope over the ocean. This area looks promising for reptiles during a period of warmer weather.

CONCLUSIONS AND RECOMMENDATIONS

Our surveys recorded most of amphibian and reptile species known or expected for Redwood National Park. Adjacent geographical ranges and historical sightings suggest that other species may also be present in Redwood National Park. For example, the Arboreal salamander (*Aneides lugubris*) has found ca. 30 km south of the park along Hwy. 299 (field notes, R.B. Bury). Specimens were collected earlier (by R.B.B.; now at Museum of Vertebrate Zoology) in coastal slopes at the south end of Humboldt Bay, California. This salamander frequents oak woodlands and openings, and Bald Hills is such habitat inside Redwood National Park. There is no geographic or other barrier between the park and the known locales for this species to the south. Thus, the Arboreal salamander may eventually be found in Redwood Natoinal Park in the grassland and oak-woodland habitat.

We did not find some species such as tailed frogs (*Ascaphus truei*) and Southern torrent salamandres (*Rhyacotrition variegatus*) but these are associated with seeps, headwaters and small streams that we avoided. These are known at many sites within Redwood National Park (Welsh and Ollivier 1989; Cooperrider et al. 2000).

We suggest additional work to target those species likely to range into Redwood National Park. Specifically, we recommend additional surveys in the rainy season in the Bald Hills area to search for species like the Arboreal salamander. Also, surveys are needed from late Spring into early Summer to target reptile species that may be present in the Bald Hills or along coastal slopes.

Redwood National Park remains a large tract of old-growth forest with inclusion of adjacent, regenerating logged stands. It is a veritable outdoor laboratory to delve into the ecology of communities of salamanders and other species in the absence of human disturbance. However, we currently lack an extensive inventory of this vast landscape (e.g., all park units and major habitats) and monitoring of sensitive habitats (e.g., headwater streams).

Table 1. Amphibian and reptile species encountered at Redwood National Park during surveys 22-26 March 2003.

Salamanders	
Southern Torrent salamander	*Rhyacotriton variegatus*
Pacific giant salamander	*Dicamptodon tenebrosus*
Black salamander	*Aneides flavipunctatus*
Del Norte salamander	*Plethodon elongatus*
Ensatina salamander	*Ensatina escholtsii*
Oregon slender salamander	*Batrachoseps attenuatus*
Northwestern salamander	*Ambystoma gracile*
Rough-skinned newt	*Taricha granulosa*
Anurans	
Northern red-legged frog	*Rana aurora*
Western toad	*Bufo boreas*
Pacific tree frog	*Hyla regilla*
Snakes	
California red-sided garter	*Thamnophis sirtalis*
Lizards	
Southern alligator lizard	*Elgaria multicarinata*
Northern alligator lizard	*Elgaria coerulea*
Western fence lizard	*Sceloporus occidentalis*
Western skink	*Eumeces skiltonianus*

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Appendix C. Data from the detectability investigation in Redwood National Park March 23-26, 2003.

Site 1
Off Bald Hills Road

March 23, 2003
Brome McCreary, Erin Hyde
Air T at 1m 4°C

Habitat Description

Quad1	10% DWD	LL depths: 30cm, 25cm, 40cm, 75cm, 60cm
Quad2	20% DWD	LL depths: 45cm, 55cm, 20cm, 20cm, 25cm
Quad3	5-10% DWD	LL depths: 70,20,55,40,25
Quad4	10% DWD	LL depths: 30,20,40,25,25

First Sample beginning @ 0930. 1 person hour

ID	SP	SVL	TL	Substrate	Sub Size
1	BAAT	28	60	LL/DUFF	
2	ENES	19	32	LL/DUFF	
3	ENES	47	91	LOG	100cm x 7cm dia
4	BAAT	39	89	LL	
5	BAAT	39	89	LL	
6	ENES	21	36	LL	

Second Sample – 1 person hour

ID	SP	SVL	TL	Substrate	Sub Size
7	BAAT	37	87	LL	
8	BAAT	37	101	LL	
9	BAAT	41	84	LOG	30cm X 20dia
10	ENES	40	76	STICK	7cm dia x 100cm

Third Sample – 44 person minutes

ID	SP	SVL	TL	Substrate	Sub Size
11	BAAT	41	105	LL	
12	ENES	36	69	Hole under log	8cm dia x 500cm
13	ENES	47	96	LL/DUFF	
14	ENES	23	32	LL/DUFF	Base of tree
15	BAAT	31	68	LL/DUFF	

Leaf litter searches for Site 1 done later on March 25, 2003 13:51

Site 1 Leaf Search 1
<1/4"= 165 ¼-1"=28 1-3"=6 >3"=0
litter volume=40x40x21cm

Site 1 Leaf Search 2
<1/4"=113 ¼-1"=22 1-3"=3 >3"=0
litter volume=36x35x18cm

Site 1 Leaf Search 3
<1/4"=98 ¼-1"=6 1-3"=1 >3"=0
litter volume=37x40x17cm

1	BAAT	39	61	LL/duff	Stumpy tail

Site 1 Leaf Search 4
<1/4"=94 ¼-1"=29 1-3"=1 >3"=0
log: 14x90x11cm
log: 12x8x25cm
litter volume=41x19x38cm

1	BAAT	42	96	LL/duff	

Appendix C, cont.

Site 2
Bald Hills Rd

March 23, 2003
Brome McCreary, Erin Hyde
Air Temp ~1m= 6.5°C

Redwood forest, but primary vegetation TanOak
QUAD 1: 5-10% DWD LITTER DEPTHS: 25,65,30,45,50 MM
QUAD 2: 20% DWD LITTER DEPTHS: 65,45,75,60,25 MM
QUAD 3: 15% DWD LITTER DEPTHS: 25,30,30,40,50
QUAD 4: 50% DWD LITTER DEPTHS: 80,30,45,70,50

FIRST SAMPLE : 1 PERSON HOUR

ID	SP	SVL	TL	Substrate	Sub Size
1	BAAT	36	71	D/L	
2	BAAT	39	86	D/L	
3	ENES-O	41	77	ROCK	14X22X10CM
4	BAAT	41	97	WOOD	13X11X60
5	ENES	41	65	WOOD	10X6X60
6	BAAT	42	87	WOOD	10X10X50
7	BAAT	43	69, TAILBITE	LOG	15X18X100
8	BAAT	30	63	L/D	
9	BAAT	39	77	BARK	18X6X2
10	BAAT	41	86	BARK	6X5X25

SECOND SAMPLE : 1 PERSON HOUR

ID	SP	SVL	TL	Substrate	Sub Size
11	BAAT	42	83	LL	
12	BAAT	41	46	LL	
13	BAAT	43	87	LL	
14	BAAT	41	94	LL	

THIRD SAMPLE: 36 PERSON MINUTES

ID	SP	SVL	TL	Substrate	Sub Size
15	BAAT	35	85	WOOD	7X3X30
16	BAAT	39	95	LL	

Site 2 Leaf Search 1
<1/4"= 52 ¼-1"= 11 1-3"= 10>3"= 0
log: 6x14x80cm
log: 6x13x90cm
log: 50x16x95cm
litter volume= 40x46x18cm

1	BAAT	30	37	LL/duff	

Site 2 Leaf Search 2
<1/4"= 63 ¼-1"= 11 1-3"= 3 >3"= 0
litter volume= 35x40x20cm
No salamanders

Site 2 Leaf Search 3
<1/4"= 46 ¼-1"= 15 1-3"= 1 >3"= 0
litter volume= 36 x 40 x 28cm
<1/4"= 54 ¼-1"= 8 1-3"= 0 >3"= 0
litter volume=45x44x22cm

1	BAAT	47	92	LL/duff	

Appendix C, cont.

Site 3 **March 24, 2003**

09:30-11:45 Willow Wegner, Erin Hyde

Redwood Creek Trail; Tall Trees Trail Overcast Clouds 10°C

Old-growth redwood forest with sword fern under story with some salmonberry. Ground cover of sorrel. Thick redwood needles and duff layer. 18°Slope. 208°Aspect. 10x10m plot

Quad 1	<5% LWD	40% Fern Base	Litter+Duff = 80,100,50,90,75mm
Quad 2	Large Redwood Circumference:		
	5-10% LWD	15% Fern	Litter+Duff= 80,65,50,60,70
Quad 3	5-10% LWD	20% Fern bases	Litter+Duff= 90,70,60,90,80mm
Quad 4	30% Fern	<5% LWD	Litter+Duff=100,90,70,100,80mm

Stage 1 – 60 person minutes

ID	SP	SVL	TL	Substrate	Sub Size
1	ENES	43	84	LL/DUFF	
2	ENES	40	104	LL/DUFF	
3	BAAT	35	98	LL/DUFF	

Stage 2 – 60 person minutes

ID	SP	SVL	TL	Substrate	Sub Size
4	BAAT	33	70	LL/DUFF	
5	ENES	34	63	LL/DUFF	
6	ENES	18	44	LL/DUFF	
7	BAAT	25	57	LL/DUFF	
8	BAAT	29	59	On log under needles	6 cm dia x 200cm
9	BAAT	36	92	LL/DUFF	

Stage 3

ID	SP	SVL	TL	Substrate	Sub Size
10	ENES	35	67	LL/DUFF	
11	ENES	41	78	LL/DUFF	

No leaf litter samples taken on March 24.
Instead, Willow and Chris R. returned on March 26th to take leaf litter samples from this plot. Data are as follows:

Leaf Litter 1 Altitude 31ft

Air Temp: 10.5C Substrate Temp: 3.1C

Stick volume: 200x25x5cm

Litter/Duff volume: 63x30x25cm

<1/4= 81 ¼-1= 19 1-3= 4 >3= 0

1	BAAT	25	54	L/DUFF	
2	BAAT	35	76	LL/DUFF	

Appendix C, cont.

Site 3: Leaf Litter 2

Stick volume: 70x61x27cm
Litter/Duff volume: 45x37x30cm
<1/4= 5 ¼-1= 1 1-3= 44 (mostly bark) >3= 5 (large pieces of bark)

1	ENES	37	65	Under bark	25x5x2cm
2	BAAT	37	83	LL/Duff	

Site 3: Leaf Litter 3

Stick volume: 65x40x25cm
Litter/Duff volume: 55x47x30cm
<1/4= 47 ¼-1= 12 1-3= 3 >3= 0

1	BAAT	45	84	In duff w/missing tail	
2	BAAT	43	79	In duff	

Site 3: Leaf Litter 4

Stick volume: 80x45x30cm
Litter/Duff volume: 50x45x45cm
<1/4= 57
¼-1= 34 1-3= 5 >3= 0

1	BAAT	42	54	Leaf litter	Missing tail

SITE 4 **MARCH 24, 2003**
Start Time 13:20 Willow Wegner, Erin Hyde
Aspect 96° Slope 19°

Overcast Skies

Redwood and Tanoak forest, but no standing Redwood in plot. Fern understory. Ground has very few herbs/forbs.

We started the first survey, but after the first 30 minutes, we had only finished a tiny portion of the plot because the only surface to sample was leaf litter. We sampled continuously for 78 minutes to complete the first sample. We then did a second sample.

Quad 1

LWD <5%; 15% ferns
Litter + Duff: 40,40,35,30,40mm
Quad 2
LWD: <5%; 10-20% Ferns
Litter: 50,40,30,40,70mm
Quad 3
LWD: 5-10% Ferns: 25%
Litter + Duff: 30,60,55,70,50 mm

Appendix C, cont.

Quad 4
LWD: <5% Ferns:5-10%
90,30,20,30,40mm

ID	SP	SVL	TL	Substrate	Sub Size
1	BAAT	36	90	L/D	
2	BAAT	32	77	L/D	
3	ENES	19	33	L/D	
4	BAAT	30	61	L/D	
5	BAAT	30	63	L/D	
6	ENES	26	50	BARK	15X11X1CM
7	BAAT	32	74	L/D	
8	BAAT	34	77	L/D	
9	BAAT	34	56	L/D	
10	BAAT	21	52	L/D	
11	BAAT	33	72	UNDER BARK	9X100X1CM
12	BAAT	25	54	L/D	REGENTAIL
13	ENES	28	52	L/D	
14	BAAT	21	39	L/D	
15	BAAT	32	71	L/D	
16	BAAT	32	74	L/D	

END OF 30 MINUTES: SAMPLING CONTINUES… 2ND 60 person MINUTEs

ID	SP	SVL	TL	Substrate	Sub Size
17	ENES	39	77	L/D	
18	BAAT	26	61	L/D	
19	ENES	17	31	L/D	
20	BAAT	31	53	L/D	
21	BAAT	31	68	L/D	
22	BAAT	25	53	L/D	
23	BAAT	35	81	L/D	
24	BAAT	28	42	L/D	REGEN TAIL

End of 30 minutes: Sampling continues…Third period – 36 person minutes

25	ENES	33	55	L/D	
26	ENES	29	48	L/D	
27	BAAT	36	77	L/D	
28	BAAT	35	79	L/D	
29	BAAT	18	32	L/D	

AREA COMPLETED
SECOND AREA SURVEY: 36 person minutes

1	ENES	17	32	L/D	
2	BAAT	31	63	L/D	

SITE 4 Leaf Litter 1 1600hrs
Stick Volume 36x3x14cm

Sticks
<1/4 = 133 ¼-1 = 10 1-3 = 3 >3 = 0
Litter Litter Dimensions 48cmx34cmx24

1	BAAT	39	79	L/D	
2	BAAT	39	85	L/D	
3	BAAT	41	83	L/D	

SITE 4 LEAF LITTER 2 16:45
Stick Volume 48x23x8cm
Sticks
<1/4 = 35
¼-1 = 20 1-3 = 1 >3 = 0
Leaf litter volume: 32x29x14cm

SITE #4 Leaf Litter 3
Stick volume 51cmx25cmx13cm
Sticks
<1/4 = 52 ¼-1 = 11 1-3 = 4
Leaf litter dimensions: 44cmx34cmx18cm
No Salamanders

No 4th Leaf Litter Search at this time.
Returned on 3/26 with Willow and Chris to conduct 4th LL search
Weather: cloudy, dry, no wind
Volume Litter: 47x35x23cm
Volume Sticks: 55x40x5cm
<1/4=31 ¼-1"=16 1-3"=2
No Salamanders

Appendix C, cont.

SITE # 5 **MARCH 25, 2003**

E Hyde; B. McCreary

Raining, No Wind Air= 10degC

Slope 17deg

Elevation 473m
10m x 10m
D. Fir /Redwood old growth forest; Sparse understory of doug fir; Some fern but fairly open. Redwood needles as cover.

Search One: 60 person minutes

1	ENES	45	78	LL	
2	ENES-tiger	36	64	STICK	4.5X4.5X87CM
3	BAAT	37	83	LL	
4	ENES	37	85	LL	
5	ENES	40	74	LL	
6	BAAT	32	69	LL	
7	BAAT	37	78	LL	
8	ENES	44	78	LL	
9	BAAT	34	70	LL	
10	BAAT	23	58	LL	
11	BAAT	39	94	LL	
12	ENES	39	67	LL	
13	BAAT	40	78	LL	

Search Two: 60 person minutes

14	BAAT	44	94	LL	
15	BAAT	36	75	LL	
16	BAAT	34	71	LL	
17	BAAT	32	71	LL	
18	BAAT	38	83	LL	
19	ENES	20	32	LL	
20	BAAT	37	73	LL	

SEARCH THREE: 60 PERSON MINUTES

21	ENES	43	91	LL	
22	BAAT	38	77	LL	
23	BAAT	37	73	LL	

QUAD 1:
5% LWD
0% FERN
LITTER+DUFF: 30,20,24,30,20MM

QUAD 2:
<5% LWD
FERN: 0%
LITTER +DUFF: 22,32,35,20,20MM

QUAD 3:
LWD 15%
FERN <5%

Appendix C, cont.

660CM CIRCUMFERENCE Doug Fig
LITTER+DUFF: 20,80,30,20,22 MM

QUAD 4:
15% LWD
<5% FERN
LITTER+DUFF: 25,30,30,28,65 MM

(INCIENTAL: found DITE Adult 11SVL/82tail)

PLOT 5
Leaf Litter Searches
Litter Search 1:
<1/4 = 79
¼-1 = 28 1-3 = 1 >3 = 0
Leaf litter dimensions: 30x26x20cm

Litter Search 2:
<1/4 = 24
¼-1 = 16 1-3 = 6 >3 = 0
Leaf litter dimensions: 35x27x12cm
BAAT 34SVL/78TL

Litter Search 3:
<1/4 = 92
¼-1 = 30 1-3 = 9 >3 = 0
Leaf litter dimensions: 37x33x28cm
ENES: 45svl/75TL Male

Litter Search 4:
<1/4 = 32 ¼-1 = 6 1-3 = 0
>3 = 0
Leaf litter dimensions: 35x30x15
BAAT 42SVL/86TL
BAAT 41SVL/51TL

Appendix C, cont.

SITE 6 ***MARCH 26, 2003***

Erin Hyde and Brome McCreary

Just upstream from junction of trail with N. Fork Lost Man Creek
Redwood Old Growth

QUAD 1:
0% LWD
25% Fern bases
Litter + Duff: 65,70,40,50,80mm

QUAD 2:
0-5% LWD
30% Fern Bases
Litter+ Duff: 75,30,50,35,50mm

QUAD 3:
5-10% LWD
20% Fern
Litter + Duff 30,110,70,65,40mm

QUAD 4:
35% Fern Bases
10% LWD
Litter + Duff: 25,50,90,50,60mm

Search One: 60 person minutes
Start Time 0910

1	BAAT	39	97	LL/DUFF	
2	BAAT	36	74	LL/DUFF	
3	BAAT	46	76 TAIL REGEN	ROOT	1.5X40CM
4	BAAT	33	77	LL/DUFF	
5	BAAT	38	56	LL/DUFF	TAIL REGEN
6	DITE	114	220	LOG	

SEARCH 2 60 PERSON MINUTES

7	BAAT	40	93	LL/DUFF	
8	ENES	21	34	LL/DUFF	
9	BAAT	32	63	LL/DUFF	REGEN TAIL
10	BAAT	29	53	LL/DUFF	
11	BAAT	38	84	LL/DUFF	

SEARCH 3 36 PERSON MINUTES

	NONE				

LEAF LITTER SEARCH #1
<1/4" = 33 ¼-1" = 12 1-3" = 0
LOGS: 20CM X 9.5CM X 100CM
LEAF LITTER VOLUME: 40CM X 31CM X 14CM

Appendix C, cont.

LEAF LITTER SEARCH #2
<1/4" = 23
¼-1" = 7 1-3" = 3 LOGS = 0
LEAF LITTER VOLUME = 35X30X17CM

1	BAAT	27	52	LL/DUFF	

LEAF LITTER SEARCH #3
<1/4" = 66
¼-1"=15 1-3"=6 LOGS=0
LEAF LITTER VOLUME=32x38x14cm

1	BAAT	41	98	LL/DUFF	

LEAF LITTER SEARCH #4
<1/4" =38 ¼-1"=9 1-3"=1 LOGS=0
LEAF LITTER VOLUME=34X35X16CM
NO SALAMANDERS

Site 7 **25 March 2003**
Location: ~1/2 mile from trailhead, Dolason Prairie Trail Willow Wegner and Chris Rombaugh
Aspect= S/SW facing
AirTempStart=3.4C; SubstrateTempStart=5.3C; AirTempEnd=3.2C; SubstrateTempEnd=5.7C
Weather= moderate to heavy rain, wind=3 from W/NW (outside trees), 100% low nimbostratus cloud cover
Vegetation: Reprod (~60 year) doug fir over early successional alder and chinkapin oak; open flooor with few young alder and sword fern. 5 fir stems in plot. 2 alder stems in plot. 1 chinkapin stem in plot. Whole area is old logged redwood. Duff= doug fir needles with alder leaves.
Slope:13deg

Quad 1: 10-20% LWD
<5% Sword Fern
Litter+ Duff: 65,20,40,40,30

Quad 2: 5-10% LWD
<5% sword Fern
Litter + Duff: 20,15,40,30,30

Quad 3: 30-40% lWD coverage
<5% Sword Fern Coverage
Litter + Duff: 20,40,10,60,50

Quad 4: 20-30% LWD coverage
<5% Sword Fern Coverage
Litter + Duff: 20,40,30,60,30

First Search: 1 person hour 1008 to 1038

1	BAAT	39	86	DUFF	

SECOND SEARCH: 1 PERSON HOUR 1040 TO 1110

2	ENES-PICTA	46	104	DUFF AT BASE OF TREE	

THIRD SEARCH: 30 PERSON MINUTES (1115-1130)
No amphibians

SITE 7- LITTER 1
<1/4" =131 ¼-1" =12 1-3" =0 >3"(LOGS) =0
LITTER VOLUME = 45X35X15CM
STICK PILE=60X40X10CM
No Salamanders

SITE 7- LITTER 2
<1/4" =42 ¼-1" = 14 1-3" =1 >3"(LOGS) =0
LITTER VOLUME = 51X37X14CM
STICK PILE=55X37X15CM
No Salamanders

SITE 7- LITTER 3
<1/4" =87 ¼-1" =2 1-3" =0 >3"(LOGS) =0
LITTER VOLUME =48X35X17CM; STICK PILE=30X30X7CM

1	ENES	19	34	LL/DUFF

SITE 7- LITTER 4
<1/4" =11 ¼-1" =2 1-3" =7 >3"(LOGS) =0
LITTER VOLUME =50X41X29CM; STICK PILE=40X20X5CM
No Salamanders

SITE 8 ***March 25, 2003***

Off Bald Hills Road (South Side) W. Wegner and Chris Rombough
Adjacent to small stream about ½ m x 5-8cm deep
Old-growth Redwood forest with salal dominating. Also, sword fern and salmonberry.
2 large trees (1 Redwood 6 ft diameter & 1 doug fir 4 ft diameter)

Substrate Temp at Start: 3.5C; Air Temp at Start: 10.2C; Weather: Very rainy. Cloudy, wind 2 from SW
Aspect: W facing 234deg

Quad 1: % LWD: <5%
% Fern: 10%
Leaf + duff= 15,90,30,46,44

Quad 2: % LWD: <5%
% Fern: 60%
Leaf + duff= 45,20,48,64,30

Quad 3: % LWD: 20%
% Ferns: 65
litter + Duff= 55,40,42,20,15

Quad 4: % LWD: 10
Ferns: 15-20%
Litter + Duff: 55,85,15,44,70%

Appendix C, cont.

First Sampling : 60 person minutes; 1521-1551

1	BAAT	40	93	LL/DUFF	
2	BAAT	37	85	LL/DUFF	
3	BAAT	40	80	LL/DUFF	

Second Sampling: 60 person minutes; 1552-1622

4	RHVA	46	72	LL/DUFF ON SLOPE BY STREAM	
5	BAAT	45	96	LL/DUFF	
6	BAAT	37	81	LL/DUFF	
7	ENES PICTA	37	63	IN LOG	1X.5X.5M (female)
8	ENES PICTA	34	64	IN LOG 1X.5.X.5M	FEMALE

Third Sampling: 16:40-1705 50 person minutes

9	DITE(TERR)	82	143	LL/DUFF	
10	BAAT	46	100	LL/DUFF	
11	BAAT	41	94	LL/DUFF	ADJ TO LOG 2X.5X.5M

END TEMPS
AIR T=11C
SUBSTRATE T = 3.4 C
Site 8 – LEAF LITTER 1

<1/4" = 12 ¼-1" = 4 1-3"= 3
LOGS = NONE
LITTER VOLUME= 40X34X25CM; STICK VOLUME= 20X15X5CM
No salamanders.

Site 8 – LEAF LITTER 2
<1/4" = 31 ¼-1" = 7 1-3"=8 LOGS = 0
LITTER VOLUME= 37X22X22CM
STICK VOLUME= 200 X 50X 10CM; NO SALAMANDERS

Site 8 – LEAF LITTER 3
<1/4" = 11
¼-1" = 15
1-3"=0
LOGS =0
LITTER VOLUME= 40X30X27
STICK VOLUME= 45X20X10

1	BAAT	34	87	DUFF	

Site 8 – LEAF LITTER 4-too dark to complete 4th leaf litter sample
Returned 3/26/03 to take 4th LL
<1/4" = 18 ¼-1" = 8 1-3"=5 LOGS =0
LITTER VOLUME= 40x35x25; STICK VOLUME= 30x25x15

Appendix C, vont.

1	BAAT	37	78	Ll/Duff	
2	BAAT	47	84	LL/Duff	
3	BAAT	32	70	LL/Duff	

*** Found a juvenile clouded salamander
ANFE 21SV/41TL found under 40x15x9cm redwood bark next to road on pulloff next to our site

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Site 9 March 26, 2003

Redwood Creek Trailhead (Tall Trees Trail) Willow Wegner and Chris Rombaugh
Aspect: 208deg (S); Slope: 12deg at 10m; Air temp: 3.9C? (bad thermometer?)
Substrate: 3.9C
Weather: cloudy, light rain, no wind.

Vegetation Community: old growth redwood forest with tan oak, ground cover redwood needles and wood sorel (1 big redwood in plot – 12 ft dbh)

QUAD 1: 15% LWD
20% coverage by ferns
LL depths: 62,44,53,75,150mm

Quad 2: <5% LWD
5-10% coverage by ferns
LL depths: 75,95,87,72,38mm

Quad 3: 5-10% LWD
5-10% coverage by ferns
LL depths: 60,85,80,102,108mm

Quad 4: 5-10% LWD
<5% ferns
LL depths: 110,140,110,120,90mm

First Search: 10:56-11:36

1	BAAT	43	98	LL/DUFF	
2	BAAT	38	80	LL/DUFF	
3	BAAT	47	116	LL/DUFF	
4	BAAT	38	82	LL/DUFF	
5	BAAT	46	115	LL/DUFF	
6	BAAT	41	90	LL/DUFF	
7	BAAT	37	77	LL/DUFF	
8	ENES**	17	29	LL/DUFF	JUV
9	BAAT	42	94	LL/DUFF	
10	BAAT	34	72	LL/DUFF	AT BASE OF REDWOOD*
11	BAAT	34	72	“	“
12	BAAT	42	92	“	“
13	BAAT	36	67	“	“
14	BAAT	38	87	“	“

15	BAAT	37	82	“	“
16	BAAT	36	86	“	“
17	BAAT	37	94	“	“
18	BAAT	38	76	“	“

**Enes: sides paler, belly transparent, 3 vertical bars oneach side, dark colored. Dorsal surface of tail has dark reticulations

*All these found at base of large redwood in a depression between the redwood and a very decayed stump

Second Search: 11:40-12:10

19	BAAT	41	63	LL/DUFF	REGEN TAIL
20	ENES*	34	57	DUFF/LOG	100X10X10CM
21	BAAT	36	82	DUFF	
22	BAAT	37	96	DUFF	
23	BAAT	44	96	DUFF	
24	BAAT	42	87	DUFF BY FERN	TAIL REGEN
25	BAAT	30	62	“	
26	BAAT	38	87	DUFF	
27	ENES	35	66	DUFF/LOG	.5X.5X.10 M BARK
28	BAAT	38	92	DUFF	
29	BAAT	32	74		

*Enes mustard yellow with green eye lids and dark reticulation. Probably juvenile male.

Third Search: 12:11-12:31

30	BAAT	38	72	Ll/Duff	

Site 9 Litter Search 1: West Plot

Air temp: 10.2C

Substrate temp: 10.7C

Stick Volume: 70x40x20cm

Litter Volume: 40x40x35cm

<1/4”= 59 1/4"-1” = 24 1-3”= 8 >3”= 0

1	BAAT	37	81	Ll/Duff	

Site 9 Litter Search 2: North Plot

Stick Volume: 65x35x35cm

Litter Volume: 58x40x34cm

<1/4”= 64 1/4"-1” = 17 1-3”= 6 >3”= 0

No Salamanders

Site 9 Litter Search 3: East Plot

Stick Volume: 60x40x15cm

Litter Volume: 50x35x35cm

<1/4”= 50 1/4"-1” =17 1-3”=3 >3”=0

No Salamanders

Site 9 Litter Search 4: S of Plot

Stick Volume: 45x25x5cm

Litter Volume: 60x40x20cm

<1/4”= 7 1/4"-1” =9 1-3”=0 >3”=0

1	BAAT	40	100	duff	